Price Discrimination Bans on Dominant Firms*

Jan Bouckaert†, Hans Degryse‡, and Theon van Dijk§

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Abstract

Competition authorities and regulatory agencies sometimes impose pricing restrictions on firms with substantial market power – the "dominant" firms. We analyze the welfare effects of a ban on behaviour-based price discrimination in a two-period setting where the market displays a competitive and a sheltered segment. A ban on "higher-prices-to-sheltered-consumers" decreases prices in the sheltered segment, relaxes competition in the competitive segment, increases the rival's profits, and may harm the dominant firm's profits. We show that a ban on "higher-prices-to-sheltered-consumers" increases the dominant firm's share of the first-period market. A ban on "lower-prices-to-rival's-customers" decreases prices in the competitive segment, lowers the rival's profits, and augments the consumer surplus. In particular, while second-period competition is relaxed by a ban on "lower-prices-to-rival's-customers", first-period competition is intensified substantially, which leads to lower prices "on-average" over the two periods. Our findings indicate that a dynamic two-period analysis may lead to conclusions opposite to those drawn from a static one-period analysis.

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†University of Antwerp, Department of Economics, Prinsstraat 13, B-2000 Antwerp, Belgium. jan.bouckaert@ua.ac.be.

‡Tilburg University, TILEC, K.U. Leuven and CESIfo, PO Box 90153, NL-5000 LE Tilburg, The Netherlands. H.Degryse@uvt.nl.

§Lexonomics and Visiting Research Fellow, University of Antwerp. t.vandijk@lexonomics.com.

1 Introduction

Firms with significant market power ("dominant" firms) are typically treated differently under competition law or regulation than are firms without such market power.[1] Under *competition law*, as exemplified by Article 82 of the EC Treaty which prohibits the abuse of a dominant position, dominant firms may be considerably limited in their freedom to set prices in response to increased competition. For example, pricing policies adopted by dominant firms to meet rivals' pressure in competitive segments, are only allowed insofar as they do not create exclusionary effects. This different treatment of dominant firms can imply decisions such as banning specific price discrimination practices. The European Commission has, for example, concluded that offering selective price cuts to a subset of customers can be regarded as abusive. These price cuts do not have to constitute predatory pricing; selective price cuts above marginal costs may also be regarded as abusive under EC competition law.[2] Consider, for example, the case of Irish Sugar, in which Irish Sugar granted special rebates to specific customers established in particular county areas of the Irish Republic bordering with Northern Ireland, while it left prices in other counties unchanged. These rebates were introduced to respond to the imports of cheaper retail packets from Northern Ireland into certain border counties of the Irish Republic. The European Commission concluded that the practice of selective price cutting was intended to protect the dominant market position of Irish Sugar and therefore constituted an abuse of dominance. This conclusion was upheld by the Courts.[3] In another instance, British Gas charged prices to its industrial customers, depending on their available alternatives (UK Monopolies and Mergers Commission, 1988).[4] Customers for whom it was difficult to switch away from gas were charged higher prices than were customers with dual-firing equipment. Following an investigation by the

[1] Under EC competition law, a company in a dominant position has "a special responsibility not to allow its conduct to impair genuine undistorted competition in the Common Market." The dominant position referred to in Article 82 of the Treaty refers to a position of economic strength enjoyed by an undertaking which enables it to prevent effective competition being maintained on the relevant market by giving it the power to behave to an appreciable extent independently of its competitors, customers, and ultimately of its consumers (taken from *United Brands*, 1978).

[2] The European Commission, in a seminal decision upheld by the Courts, fined AKZO for abusing its dominant position by offering selective predatory prices *below* average variable costs to customers of its smaller rival ECS. Case C-62/86, *AKZO Chemie BV v. Commission*, [1991] E.C.R. I-3359, [1993] 5 C.M.L.R. 215. See also Phlips and Moras (1993) for an extensive description and a critical interpretation of the facts and the final decision.

[3] For another case, see Compagnie Maritime Belge. See also Geradin and Petit (2006) for an extensive discussion on price discrimination in the context of Article 82.

[4] See also Dixon and Easaw (2001).

Monopolies and Mergers Commission, the freedom to price discriminate between these groups of customers was removed. In another instance, the Swedish Competition Authority sued the dominant operator TeliaSonera in 2005 because it "selectively offered more favourable terms to private customers who cancelled their fixed-line telecom subscriptions and switched to a competitor."[5]

Moreover, in liberalised sectors such as telecommunications or electricity, incumbent (dominant) firms often face *ex ante* regulatory restrictions (as opposed to *ex post* competition rules) to compete with entrants in their attempts to "win back" customers that switched. These restrictions consist of prohibiting the incumbent operator from offering lower prices selectively to customers that moved their business relationship to a competitor, whilst at the same time maintaining higher prices for their captive consumers. For example, in order to prevent incumbent telephone or cable operators (like ILECs in the US) from engaging in such selective price-cutting behaviour, the US Congress enacted a uniform rate requirement in 1992 in Section 623(d) of the Communications Act, where "[A] cable operator shall have a rate structure, for the provision of cable service, that is uniform throughout the geographic area in which cable service is provided over its cable system." Congress argued that the goal of Section 623(d) was "to prevent cable operators from dropping the rates in one portion of a franchise area to undercut a competitor temporarily."[6]

These competition and regulatory cases illustrate that competition authorities and regulatory bodies closely monitor and do not always favour behaviour-based price discrimination practices of dominant firms involving selective price cutting or win-back strategies.[7]

[5] The Swedish Competition Authority sued Teliasonera because its "aim was to attract these customers back to TeliaSonera's fixed-line telecom network by offering them better terms than the company offered its other customers." (http://www.kkv.se/t/NewsPage____1153.aspx)

[6] Outside the US, there have been several in-depth investigations by NRAs into win-back campaigns by incumbent telephone operators at the time of introduction of carrier (pre-) selection services. These have led to a number of cases of prohibitions and measures to make selective price cutting impossible (or at least more difficult). The Canadian Regulatory Authority in 2002 prohibited efforts by each local incumbent operator to win back clients who had chosen carrier preselection, within a three-months period. See, for example, Decision CRTC 2006-69, by the Canadian Radio Television and Telecommunications Commission, where this winback rule is explained (http://www.crtc.gc.ca/archive/ENG/Decisions/2006/dt2006-69.htm) Similarly, the Spanish Commission for the Telecommunications Market (the NRA) decided in 2003 that Telefonica had to refrain from taking actions to win back any customer with carrier preselection from an alternative operator, until the expiration of a four-months period (Bird&Bird, 2003).

[7] In May 2004, the London Stock Exchange launched Eurosets, a trading platform service in Dutch securities. Euronext, the dominant market in Belgian, Dutch, French and Portuguese securities, responded by lowering its fees for Dutch securities only. This selective price cut has led to close monitoring of Euronext behavior by the

In this paper, we compare the competitive and welfare effects of different price discrimination bans imposed on the dominant undertaking. To do so, we introduce a model where firms compete for consumers during two periods. After the first period, a price discrimination ban is imposed on the dominant firm for the second period. This two-period set-up is appropriate given the observation that firms often have pricing strategies that essentially contain intertemporal aspects in competitive situations. In particular, when firms compete on a new market, they often cannot initially judge consumers' relative preferences. As a result, they charge uniform prices in the beginning and may engage in selective price setting only later on. Similarly, when an entrant becomes active on a competitive segment of the incumbent, neither player can distinguish customers with a high preference for the incumbent from others until the entrant has taken away some market share. In other words, before the incumbent can win back some of its previous customers, a competing undertaking must lure away some of its customers, so an intertemporal aspect inevitably appears.[8] Our analysis shows that when firms and consumers anticipate that a ban will constrain the dominant firm at a later stage, competitive effects hinge crucially on the type of price discrimination ban.

In our analysis, we study two price discrimination bans that produce opposing competitive effects. The first pricing restriction is a ban on "higher-prices-to-sheltered-consumers", which forbids price discrimination by the dominant firm between the customers it served in the first period. That is, the dominant firm cannot charge a higher price in the second period to customers the rivals cannot serve (the sheltered segment) relative to its first-period customers in the competitive segment. However, it can still charge a different price in the competitive segment to expand business and attract new customers in the second period. This pricing restriction relates to British Gas where *ex post* intervention was mainly driven by the concern of the competition authorities to protect the sheltered consumers from being overcharged. The second restriction we consider is a ban on "lower-prices-to-rival's-customers" and forbids price discrimination within the competitive segment in the second period.[9] This ban relates, for example, to

European Commission.

[8] In the Irish Sugar case, the dominant undertaking granted rebates only to customers that had switched away to a competing undertaking, while loyal customers did not receive rebates. Paragraph 60 of the Commission Decision97/624/ECof 14 May 1997 reads: "He [The managing Director of Irish Sugar's Distributing Company] went through the individual customers he [] had taken back and these amounted to [. . .] customers out of a total of [. . .] that he has given it to. The other [. . .] are loyal ones who have always remained with him but who were under pressure in the areas involved."

[9] This ban reflects existing regulatory restrictions on win-back campaigns as in the 1992 US Communications Act mentioned above. Similarly, in the UK, Oftel announced that it would intervene promptly against

ex ante regulations imposed on incumbents in the European telecom sector that prohibit them from charging different prices in the competitive segment.

By combining the two pricing restrictions – a ban on "lower-prices-to-rival's-customers" together with a ban on "higher-prices-to-sheltered-consumers"– a general price discrimination ban or "uniform pricing obligation" results. It restrains the dominant firm from setting different prices both across the two segments *and* within the competitive segment. The uniform pricing obligation relates to competition cases as described previously.

Our two-period analysis yields the following results. First, a ban on "higher-prices-to-sheltered-consumers" reduces competition in the competitive segment as well as consumer welfare and enhances the rival's profits. This ban harms the dominant firm when its profits from the sheltered segment are sufficiently important. It increases the dominant firm's first-period market share while reducing its market share in the second period. By building up more first-period market share in the competitive segment, the dominant firm can maintain higher prices on its sheltered segment in the second period. Although this ban increases consumer surplus in the sheltered segment, consumer surplus decreases in the competitive segment. The reasoning is that discounted average prices increase and fewer consumers are served by their most preferred supplier.

Second, a ban on "lower-prices-to-rival's-customers" relaxes second-period competition in the competitive segment. Competition over both periods, however, is keener than when there is complete pricing flexibility as the first-period demand becomes substantially more elastic. The ban on "lower-prices-to-rival's- customers", therefore, increases consumer welfare in the competitive segment.

Third, a uniform pricing obligation reduces each firm's profits in the competitive segment when the sheltered segment is small, but it enhances profit when the size of the sheltered segment is large. As a result, the importance of the sheltered segment determines the extent to which a uniform pricing obligation influences consumer welfare.

Armstrong and Vickers (1993) consider the competitive and welfare effects of a price discrimination ban on the dominant firm.[10] In their one-period model, the market consists of

British Telecom as soon as it started to set up win-back campaigns (see Bird&Bird, 2003). In 2004 Ofcom investigated a complaint by *Tele2* that *BT* had misused information provided in the context of interconnection by approaching customers that had switched from *BT* to *Tele2*. Although Ofcom did not find a breach of information rules by *BT*, this case illustrates that Ofcom scrutinizes *BT*'s win-back strategies. See http://www.ofcom.org.uk/bulletins/comp_bull_index/comp_bull_ccases/closed_all/cw_747/

[10] See also Vickers (2005).

two segments. The first is a sheltered segment, in which the dominant firm has a monopoly. The dominant firm, however, competes in prices with a price-taking entrant on the remaining competitive segment. They find that a ban on price discrimination decreases the price in the sheltered segment while, given entry, the price rises in the competitive segment. The reasoning is that, with uniform pricing, the incumbent monopolist protects its sheltered segment and, consequently, responds less aggressively to entry. Prices, however, may fall in both segments when entry happens as the result of a price discrimination ban. While the welfare effects from banning price discrimination are ambiguous, an important result in their model is that a ban on price discrimination generally results in entry on a larger scale.

We consider a two-period model in the spirit of Armstrong and Vickers (1993), with strategic interaction in the competitive segment. In our model, the dominant firm charges the monopoly price in its sheltered segment when it can set its prices unrestrainedly. In the competitive segment, however, the incumbent firm and its rival compete with uniform prices in the first period and practice behaviour-based price discrimination in the second period, as in Fudenberg and Tirole (2000). Without any imposed restriction on the prices charged, the dominant firm optimally sets two different prices in the first period and three prices in the second period. As a result, a qualification must be made as to how the incumbent's freedom to set prices becomes restricted following restraints imposed by, for example, a competition authority. Our model distinguishes between different pricing restrictions imposed on the dominant undertaking.

We emphasize that evaluations of price discrimination bans may heavily depend on the type of the ban. Moreover, the results of a dynamic two-period model may lead to conclusions contrary to those from a static one-period model. In particular, when there is a ban on "higher-prices-to-sheltered-consumers", discounted average prices in the competitive segment are higher. This result is in line with Armstrong and Vickers (1993), who show that a ban on price discrimination in a one-period model typically facilitates competitors in the competitive segment. However, our two-period analysis shows that competition intensifies when the dominant firm is restricted by a ban on "lower-prices-to-rival's-customers", so that both firms obtain less profit. In addition, total (consumer) welfare increases with the ban as more consumers pay lower prices and are served by their most preferred provider.

A closely related paper by Chen (2007) uses three variants of a dynamic model to study behaviour-based price discrimination between competing asymmetric firms. In his model, an incumbent has a monopoly position in the sheltered segment and competes in prices for consumers with a more efficient firm in the competitive segment. Firms can engage in behaviour-

based price discrimination by observing consumers' purchase history. Chen's model shows that uniform pricing weakens competition while it is sufficient for price discrimination to enhance long-run consumer welfare when the more efficient firm in the competitive segment does not exit as a result of the incumbent's pricing strategy. Our analysis and findings differ in two respects. First, our model studies the effects on competition when a price discrimination ban is imposed on the dominant firm while its rival can still engage in price discrimination. In Chen's model, a ban restricts both firms' pricing strategies. In contrast, our modeling allows to study the asymmetric treatment of a dominant firm by a regulatory body or competition authority. Second, we show that a price discrimination ban on the dominant firm may intensify competition more than does price discrimination. Since such an asymmetric ban on the dominant firm decreases the rival's profits, it may enhance consumer welfare only when the rival firm remains in the market.

The remainder of the paper is organized as follows. Section 2 presents the model and explains the effects of the two different price discrimination bans imposed on the dominant firm. Section 3 presents a welfare analysis and provides a policy discussion. Section 4 concludes.

2 Modelling price discrimination bans on dominant firms

Consider two firms, A and B, that are active on the market during two periods. The entire market has mass 1 in each period, and consumers have inelastic and unit demand. Firm A operates on two market segments. It is a monopolist in the *sheltered segment* which has mass a, where $0 \leq a \leq 1$. Absent any ban, firm A optimally charges the consumers' willingness to pay w on this sheltered segment in each period. The second segment is the *competitive segment* and has mass $1-a$.[11] This competitive segment is modelled using a Hotelling framework where both firms A and B are present.[12] The consumers' willingness to pay v is sufficiently high to cover the competitive segment. We assume that $v < w$ in the competitive segment to avoid the price in the sheltered segment being lower than in the competitive segment. Consumers are distributed uniformly with density $1-a$ on a line with unit length, and incur transportation costs t per unit of distance. Consumers have fixed preferences over time, and firms and consumers discount the future at rate $0 \leq \delta < 1$. Firms A and B are located at opposing ends of the unit interval, with

[11] As in Armstrong and Vickers (1993) and Chen (2007), both segments are considered to be part of the same "relevant market". For example, price-sensitive consumers belong to the competitive segment, while the price-insensitive (loyal) consumers belong to the sheltered segment.

[12] We implicitly assume that B's entry costs are sufficiently low to ensure its presence. Later on, we will discuss the effects the different bans might have on B's decision to enter.

A located at 0 and B at 1. The marginal costs for the two firms on both segments are normalized to zero. The firms compete during two periods in the competitive segment. Absent any ban, the firms charge uniform prices in the first period and have a dominant strategy to resort to behaviour-based price discrimination in the second period (as in Fudenberg and Tirole (2000)).[13] This modelling framework has two possible interpretations: the first interpretation is that firm A competes with firm B on a new but related market segment; the second interpretation is that firm A had a former monopoly and firm B competes on, for example, the liberalized part of its market. Both interpretations fit our model.

We analyze two different price discrimination bans that occur in practice. The first is a ban on "higher-prices-to-sheltered-consumers" as sometimes observed in competition law cases. The second regards a ban on "lower-prices-to-rival's-customers" as sometimes imposed by regulation. To investigate the impact of each of these bans on welfare, we compare each ban to the benchmark model where firms can set their prices in an unconstrained fashion.

It is important to note that our analysis concentrates only on cases where the dominant firm (i) finds it profitable to serve its sheltered segment and to be active in the competitive segment, and (ii) has no interest in setting the same price in its sheltered segment as in the competitive segment in the first period. In other words, we limit the analysis to situations where the ban restricts the dominant firm's profits. That is, the firm that serves the sheltered segment finds it optimal to set a different price in the competitive segment.

Another assumption we make is that the firm serving the sheltered segment finds it optimal to remain or become dominant. We capture dominance by a total market share on the sheltered and competitive segment of more than 50% in period one. A dominant firm can only be accused of abusing its dominant position after a complaint has been received or after an independent investigation by the competition authority. The ban on "higher-prices-to-sheltered-consumers", therefore, applies to the second period only, i.e., after dominance is verified by competition authorities and abusive price discrimination has been observed.[14] Therefore, firms and consumers *anticipate* that the dominant firm will be accused of abusing its dominant position. Accordingly, all the players will behave in each period as if the dominant firm will be restrained in the second period by the ban. The "lower-prices-to-rival's-customers" ban imposed by regulation prohibits the dominant firm from using selective price cutting strategies to poach or win back the rival's

[13] See also Armstrong (2006a,b), Fudenberg and Villas-Boas (2005), and Stole (2005) for extensive overviews on behaviour-based price discrimination.

[14] In the event the competition authority does not observe the price discrimination practice of the dominant firm, rivals have profit incentives to make complaints.

customers in the competitive segment. All players anticipate that dominance will be observed after period one. As a result, each firm optimally chooses its prices in both periods *anticipating* the prospect that the dominant firm will not be allowed to practice a win-back or poaching strategy in the second period.

Our model analyzes the effects when firm A allegedly abuses its dominant position after the first period so the price discrimination ban applies in the second period only. We analyze the dynamic effects of the different bans as both firms and consumers anticipate that firm A will face a specific ban in the second period so both firms' first-period pricing decisions will reflect the anticipated ban on price discrimination in the second period. For convenience, we will henceforth label firm A as the dominant firm. As the proofs of the propositions in this section are straightforward, we incorporate them as much as possible into the text.

2.1 No Ban

Our analysis without ban allows complete pricing freedom for both firms. We consider the sheltered and competitive segments separately as there are no price restrictions between these two segments. Firm A is a monopolist in its sheltered segment and only faces competition in the competitive segment.

Firm A charges a price w in its *sheltered segment* in both periods. Since it is optimal for A to serve the entire sheltered segment, firm A's total discounted profits in the sheltered segment (denoted by subscript s) equal

$$\Pi_s^A = a(1+\delta)w.$$

Both firms A and B are active in the *competitive segment*. The analysis for this segment is similar to that of Fudenberg and Tirole (2000). To deal with second-period competition, assume the first-period competition results in firm A serving customers who are located "to the left of x" and firm B those "to the right of x". As the dominant firm A does not face a ban on selective price cutting, both firms will maximize their profits by practicing behaviour-based price discrimination in the second period. That is, both firms will charge different prices to their own first-period customers and to the customers of the rival. Since both firms can identify the customers positioned to the left and right of x, there are two indifferent consumers. The first indifferent consumer is at $0 \leq \alpha \leq x$ and characterized by

$$p_2^{AA} + t\alpha = p_2^{AB} + t(1-\alpha)$$

where p_2^{AA} and p_2^{AB} are A's and B's second-period prices (the right superscript), respectively,

charged to firm A's first-period consumers (the left superscript). The second indifferent consumer is at $x \leq \beta \leq 1$ and satisfies

$$p_2^{BA} + t\beta = p_2^{BB} + t(1-\beta)$$

where p_2^{BA} and p_2^{BB} are A's and B's second-period prices, respectively, charged to B's first-period consumers.

Firm A maximizes its second-period profits in the competitive segment (subscript c)

$$\Pi_{2c}^{A}(p_2^{AA}, p_2^{BA}) = (1-a)\left[p_2^{AA}\alpha + p_2^{BA}(\beta - x)\right]$$

whereas firm B will maximize

$$\Pi_{2c}^{B}(p_2^{BB}, p_2^{AB}) = (1-a)\left[p_2^{BB}(1-\beta) + p_2^{AB}(x-\alpha)\right].$$

The interior solution for a given x that results from the first-order conditions, yields equilibrium prices[15]

$$p_2^{AA} = \frac{t(1+2x)}{3}\ ,\ p_2^{BA} = \frac{t(3-4x)}{3}\ ,\ p_2^{AB} = \frac{t(4x-1)}{3}\ ,\ \text{and}\ p_2^{BB} = \frac{t(3-2x)}{3}.$$

The resulting second-period profits in the competitive segment for firm i, with $i = A, B$, are

$$\Pi_2^i = (1-a)\,\frac{5t(2x^2-2x+1)}{9}.$$

We now turn to first-period competition. The forward-looking first-period indifferent consumer in the competitive segment is located at x such that

$$p_1^A + tx + \delta[p_2^{AB} + t(1-x)] = p_1^B + t(1-x) + \delta[p_2^{BA} + tx],$$

where δ reflects the discount rate, and p_1^i is firm i's first-period price, with $i = A, B$. The indifferent consumer anticipates that if he visits firm i in the first period, it will be optimal for him to visit the other firm in the second period in order to benefit from its poaching price. After substitution of both firms' second-period prices, one obtains firm A's first-period market share in the competitive segment:

$$x = \frac{3(p_1^B - p_1^A) + t\,(3+\delta)}{2t(3+\delta)}.$$

Firm A maximizes the following total discounted profit in the competitive segment

$$\Pi_c^A(p_1^A, p_1^B) = (1-a)\left[p_1^A x + \delta\left(p_2^{AA}\alpha + p_2^{BA}(\beta - x)\right)\right]$$

[15] We will consider only the internal solution, wherefrom the first-order conditions are necessary and sufficient. In other words, x should not be too large. In particular, $x \leq 3/4$. See Fudenberg and Tirole (2000) for an extensive analysis on the conditions for an interior solution.

whereas firm B maximizes

$$\Pi_c^B(p_1^B, p_1^A) = (1-a)\left[p_1^B(1-x) + \delta\left(p_2^{BB}(1-\beta) + p_2^{AB}(x-\alpha)\right)\right].$$

From the first-order conditions, an interior solution results in

$$p_1^i = \frac{t\,(\delta+3)}{3}.$$

The second-period equilibrium prices then become

$$p_2^{AA} = p_2^{BB} = \frac{2t}{3} \text{ and } p_2^{BA} = p_2^{AB} = \frac{t}{3}.$$

The discounted profits for both firms in the competitive segment amount to

$$\Pi_c^i = (1-a)\,\frac{t(8\delta+9)}{18}.$$

In equilibrium, both firms symmetrcially serve half of the competitive segment, or $x = 1/2$, and enjoy identical profits in that segment. In the second period, one third of the consumers in the competitive segment switch supplier since $\alpha = 1/3$ and $\beta = 2/3$.

The firms' total discounted profits on the *entire market* are the combined results from the competitive and sheltered segments:

$$\Pi^A = a(1+\delta)w + (1-a)\,\frac{t(8\delta+9)}{18} \text{ and } \Pi^B = (1-a)\,\frac{t(8\delta+9)}{18}.$$

It is clear that A generates greater profits than does B as it enjoys a monopoly position in its sheltered segment. Firm A serves its sheltered segment and half of the competitive segment. Therefore its total market share becomes $a + 0.5(1-a)$. The firms' total market share remain identical in the first and second period even though they do not serve the same set of consumers.

2.2 Ban on "higher-prices-to-sheltered-consumers"

In this section the dominant firm A faces a ban in the second period and is no longer allowed *to charge higher prices to its sheltered consumers* in this period. This ban implies that A has to set an identical second-period price to all of its *first-period* consumers *across the two segments*. That is, firm A charges a second-period price $p_2'^{AA}$ to its first-period customers from both the sheltered and the competitive segments, where the " $'$ " superscript indicates the ban on "higher-prices-to-sheltered-consumers". Therefore, firm A can no longer treat its sheltered segment independently

of the competitive segment in the second period. The ban still allows firm A to poach B's first-period customers by means of a different price in the competitive segment. Thus, our modelling approach implies that the ban only becomes effective in the second period. In other words, after the firm has become dominant in the first period. Firm B, in contrast, is not restricted in its price-setting behaviour in any period. Moreover, it is a dominant strategy for firm B to practice price discrimination in the second period. Figures 1 and 2 illustrate the effects of the ban on market shares and prices in both periods.

Firm A's sheltered segment is served at a price w in the first period. The ban implies, however, that A can only charge $p_2'^{AA} < v < w$ in the second period.[16]

Consider the competitive segment. Suppose first-period competition results in firm A serving consumers to the left of x'. There are two indifferent consumers in the second period. The first indifferent consumer is at $0 \leq \alpha' \leq x'$ and characterized by

$$p_2'^{AA} + t\alpha' = p_2'^{AB} + t(1-\alpha')$$

where $p_2'^{AA}$ and $p_2'^{AB}$ is A's and B's second-period price, respectively, charged to consumers who purchased from A in the first period. It is crucial to point out that $p_2'^{AA}$ is also charged in A's sheltered segment. The other indifferent consumer is at $x' \leq \beta' \leq 1$ and satisfies

$$p_2'^{BA} + t\beta' = p_2'^{BB} + t(1-\beta')$$

where $p_2'^{BA}$ and $p_2'^{BB}$ is A's and B's second-period price, respectively, charged to consumers who purchased from B in period 1. Firm A maximizes its second-period profits on the entire market

$$\Pi_2'^{A}(p_2'^{AA}, p_2'^{BA}) = p_2'^{AA}\left[a + (1-a)\,\alpha'\right] + p_2'^{BA}\left[(1-a)(\beta' - x')\right]$$

and firm B maximizes

$$\Pi_2^{B}(p_2'^{BB}, p_2'^{AB}) = (1-a)\left[p_2'^{BB}(1-\beta') + p_2'^{AB}(x'-\alpha')\right].$$

The equilibrium prices that result are

$$\begin{aligned} p_2'^{AA} &= \frac{t\left[2x'(a-1) - 3a - 1\right]}{3(a-1)}\,,\; p_2'^{AB} = \frac{t\left[4x'(a-1) - 3a + 1\right]}{3(a-1)} \text{ and} \\ p_2'^{BA} &= \frac{t(3-4x')}{3}\,,\; p_2'^{BB} = \frac{t(3-2x')}{3} \end{aligned}$$

[16] We implicitly impose two assumptions on firm A's behaviour. The first is that firm A will find it optimal to lower its price in the sheltered segment when the ban applies. This seems reasonable since otherwise the sheltered segment would have a lower price than the competitive segment without the ban. Second, we assume that firm A finds it optimal to be active in the competitive segment when the ban applies. This will happen as long as a is not too large and/or consumers' willingness to pay in the sheltered segment is not too high.

for firm A and B, respectively.

We now turn to first-period competition. The first-period indifferent consumer anticipates that when buying from firm A in the first period and paying a price $p_1'^A$ he will receive a poaching price $p_2'^{AB}$ in the second period from firm B. By buying from firm B in the first period and paying $p_1'^B$, the indifferent consumer anticipates he will pay a price $p_2'^{BA}$ that is charged by firm A to new customers. Formally,

$$p_1'^A + tx' + \delta[p_2'^{AB} + t(1-x')] = p_1'^B + t(1-x') + \delta[p_2'^{BA} + tx']$$

or, by substituting expected second-period prices,

$$x' = \frac{3a(p_1'^A - p_1'^B - t(\delta+1)) + t(\delta+3) - 3(p_1'^A - p_1'^B)}{2t(1-a)(\delta+3)}.$$

From the necessary first-order conditions, it follows that

$$\begin{aligned} p_1'^A &= \frac{t\,(\delta+3)}{3\,(1-a)} - \frac{ta\left(81+36\delta-17\delta^2\right)}{3\,(1-a)\,(27-11\delta)} < p_1^A \text{ and} \\ p_1'^B &= \frac{t\,(\delta+3)}{3\,(1-a)} - \frac{ta\left(81-48\delta-5\delta^2\right)}{3\,(1-a)\,(27-11\delta)} > p_1^B \end{aligned}$$

are the first-period prices for firm A and B, respectively. As can be verified, both firms' first-period prices are always positive. Firm A's price is higher without the ban, whereas the opposite holds for firm B's first-period price. Firm A's first-period market share in the competitive segment is

$$x' = \frac{1}{2\,(1-a)} - \frac{3a(9-7\delta)}{2(1-a)(27-11\delta)},$$

which is greater than 0.5. Firm A's second-period market share on the competitive segment entails

$$\alpha' + \beta' - x' = \frac{1}{2\,(1-a)} - \frac{15a(3-\delta)}{2(1-a)(27-11\delta)},$$

and is less than 0.5. Firm A's total market share in both segments, therefore, decreases over the two periods. The average market share over the two periods in the competitive segment is less than 0.5, which suggests that the ban *reduces* firm A's dominance as measured by market share.

Several observations are worth mentioning. The ban on "higher-prices-to-sheltered-consumers" leads to firms charging different first-period prices. The dominant firm A sets lower prices than does firm B. The reasoning stems from two forces. First, the indifferent consumer anticipates aggressive second-period poaching by firm A when opting for firm B in the first period as $x' > 0.5$.

Second, opting for firm A in the first period leads to less aggressive second-period poaching by firm B because $x' > 0.5$.

The equilibrium second-period prices become

$$\begin{aligned}
p_2'^{AA} &= \frac{2t}{3(1-a)}\left[1+\frac{3a\,(9-2\delta)}{27-11\delta}\right] > p_2^{AA} \\
p_2'^{BA} &= \frac{t}{3(1-a)}\left[1-\frac{9a\,(3+\delta)}{27-11\delta}\right] < p_2^{BA} \\
p_2'^{BB} &= \frac{2t}{3(1-a)}\left[1-\frac{3a\,(9-2\delta)}{27-11\delta}\right] < p_2^{BB} \\
p_2'^{AB} &= \frac{t}{3(1-a)}\left[1+\frac{9a\,(3+\delta)}{27-11\delta}\right] > p_2^{AB}.
\end{aligned}$$

The equilibrium profits realized by both firms on the entire market are

$$\begin{aligned}
\Pi'^{A} &= aw + (1-a)\,\frac{t(8\delta+9)}{18} + \frac{2at\delta\left[a\left(82\delta^2-198\delta+243\right)+352\delta^2-1953\delta+2673\right]}{9(1-a)\left(27-11\delta\right)^2} \quad (1) \\
\Pi'^{B} &= (1-a)\,\frac{t(8\delta+9)}{18} - \frac{2at\delta\left[a\left(182\delta^2-648\delta+243\right)-253\delta+9(113\delta-108)\right]}{9(1-a)\left(27-11\delta\right)^2}.
\end{aligned}$$

The impact of the ban on "higher-prices-to-sheltered-consumers" as compared to the scenario where the dominant firm A can price discriminate between its first-period customers can be summarized in the following Proposition.

Proposition 1. *Compare the ban on "higher-prices-to-sheltered-consumers" to the no-ban case. A ban on "higher-prices-to-sheltered-consumers" increases the rival's overall profits. It harms the dominant firm when its profits in the sheltered segment are substantial. The ban increases the dominant firm's first-period market share but reduces its second-period market share.*

Figures 1 and 2 illustrate Proposition 1. Both figures graphically outline the main price differences between the no-ban case and a ban on "higher-prices-to-sheltered-consumers" for the first and the second period, respectively.

Three remarks are appropriate here. First, a *profit comparison* shows that the dominant firm A prefers complete flexibility when $w \geq \bar{w}$ where $\bar{w}$ satisfies $\Pi^A - \Pi'^A = 0$. Although the ban reduces the dominant firm's profits in the sheltered segment, it also reduces the rival's aggressiveness and sufficiently increases the dominant firm's profits in the competitive segment. However, when $w < \bar{w}$ its profits increase. The dominant firm then prefers to have its hands tied by this particular ban and to set a uniform price for all its first-period customers. Firm B, in contrast, benefits from such a ban as its profits are greater. In a setting with fixed entry

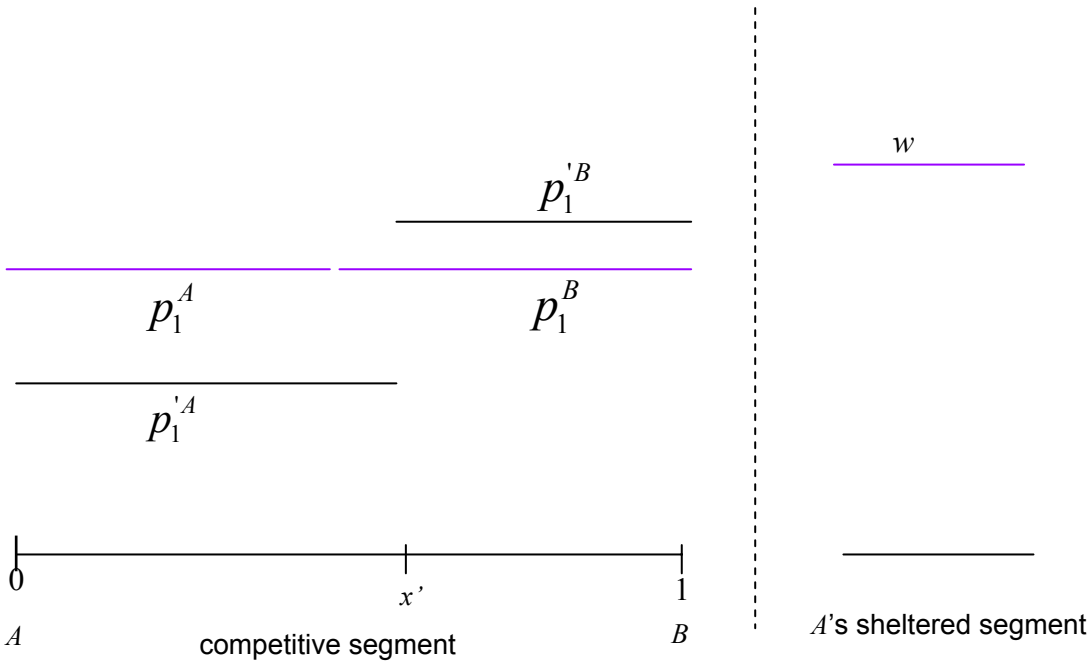

Fig. 1 'Higher-prices-to-sheltered-consumers' ban: first period

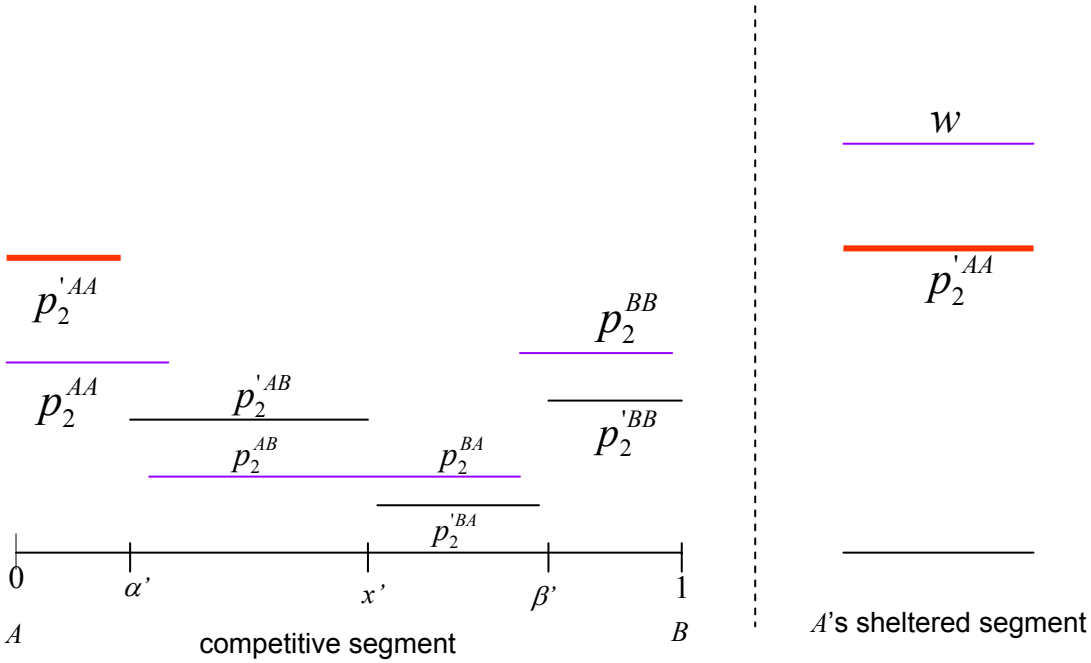

Fig. 2 'Higher-prices-to-sheltered-consumers' ban: second period

costs, this would encourage B's decision to enter the competitive segment. In other words, the ban makes the dominant firm less aggressive, which results in greater profits for firm B.

Second, the ban also produces interesting *differential intertemporal effects*. The ban on "higher-prices-to-sheltered-consumers" relaxes second-period competition in A's first-period competitive segment. This result stems from two forces. First, firm A becomes less aggressive as the ban implies that it sets an identical price for all its first-period customers. Second, x' is greater than 0.5, thus softening firm B's reaction. In contrast, second-period competition on B's first-period market becomes more intense. The reasoning is that x' is greater than 0.5, which implies a more aggressive poaching price by firm A. First-period competition with a ban compared to no ban leads to lower prices by the dominant firm and higher prices by the rival firm. The reasoning stems from two forces. On the one hand, firm A wants to build up first-period market share as the ban implies higher second-period prices for those customers. On the other hand, forward-looking consumers anticipate less aggressive second-period poaching by firm B and more aggressive poaching by firm A. This decreases consumer price sensitivity and gives the marginal consumer a preference for B at equal first-period prices.

Finally, anticipation of a ban on "higher-prices-to-sheltered-consumers" *increases the dominant firm's first-period market share*. That is, in addition to the sheltered segment, the dominant firm serves more than half of the competitive segment in the first period.

2.3 Ban on "lower-prices-to-rival's-customers"

In this section we assume that the dominant firm A is no longer allowed *to set lower prices to its rival's customers*. With such a ban, dominant firm A cannot cut prices selectively *within the competitive segment*. Firm A, however, can charge different prices across the sheltered segment and the competitive segment. Firm B does not face a ban and finds it profitable to engage in price discrimination. Technically, this implies that firm A is restricted to charge a single price $p_2''^A$ to the rival's first-period customers and its own first-period customers in the competitive segment, while firm B can charge the discriminating prices $p_2''^{BB}$ and $p_2''^{AB}$. The " $''$ " superscript denotes the ban on "lower-prices-to-rival's-customers". Figures 3 and 4 illustrate the effects of this ban on the market shares and the prices in both periods.

It should be clear that the *sheltered segment* can be treated independently from the competitive segment. Firm A optimally charges w in both periods such that its discounted profits in the sheltered segment become

$$\Pi_s''^A = a(1+\delta)w.$$

Suppose first-period competition in the *competitive segment* leads to firm A serving consumers to the left of x''. The first indifferent consumer is located at α'' such that

$$p_2''^A + t\alpha'' = p_2''^{AB} + t(1-\alpha'')$$

while the second indifferent consumer located at β'' is characterized by

$$p_2''^A + t\beta'' = p_2''^{BB} + t(1-\beta'').$$

Firm A maximizes its second-period profits in the competitive segment

$$\Pi_{2c}''^A(p_2''^A) = (1-a)\, p_2''^A \left[\alpha'' + \beta'' - x''\right]$$

and firm B maximizes

$$\Pi_{2c}''^B(p_2''^{BB}, p_2''^{AB}) = (1-a)\left[p_2''^{BB}(1-\beta'') + p_2''^{AB}(x''-\alpha'')\right].$$

The first-order conditions for the interior solution result in

$$p_2''^A = \frac{t(2-x'')}{3}\ ,\ p_2''^{AB} = \frac{t\,(5x''-1)}{6}, \text{ and } p_2''^{BB} = \frac{t(5-x'')}{6}. \tag{2}$$

We now turn to first-period competition. The forward-looking first-period indifferent consumer in the competitive segment is located at x'' such that

$$p_1''^A + tx'' + \delta[p_2''^{AB} + t(1-x'')] = p_1''^B + t(1-x'') + \delta[p_2''^A + tx''].$$

Note that the marginal consumer opting for firm B in the first period expects to be poached by firm A at a price $p_2''^A$ "only". This price is relatively high as it is identical to the price charged by A to its first-period customers in the competitive segment. In visiting firm A in the first-period, the indifferent consumer anticipates a more attractive second-period poaching price by firm B. After substitution of both firms' second-period prices, firm A's first-period market share in the competitive segment equals

$$x'' = \frac{6(p_1''^B - p_1''^A) + t\,(6-\delta)}{t(12-5\delta)}. \tag{3}$$

Firm A maximizes the following total discounted profit in the competitive segment

$$\Pi_c''^A(p_1''^A, p_1''^B) = (1-a)\left[p_1''^A x'' + \delta p_2''^A\left(\alpha'' + \left(\beta'' - x''\right)\right)\right]$$

whereas firm B maximizes

$$\Pi_c''^B(p_1''^B, p_1''^A) = (1-a)\left[p_1''^B(1-x'') + \delta\left(p_2''^{BB}(1-\beta'') + p_2''^{AB}(x''-\alpha'')\right)\right].$$

From the first-order conditions, an interior solution results in

$$p_1''^A = \frac{t\,(12-\delta)}{12} \text{ and } p_1''^B = \frac{t\,(3-\delta)}{3}.$$

The second-period equilibrium prices then become

$$p_2''^A = \frac{t}{2}\ , p_2''^{AB} = \frac{t}{4}, \text{ and } p_2''^{BB} = \frac{3t}{4}.$$

The discounted profits for both firms in the competitive segment amount to

$$\Pi_c''^A = (1-a)\,\frac{t(5\delta+12)}{24} \text{ and } \Pi_c''^B = (1-a)\,\frac{t(7\delta+24)}{48}.$$

In equilibrium, both firms serve half of the competitive segment, or $x'' = 0.5$, but their profits differ. Firm A enjoys greater profits than firm B even though it faces a ban. The reasoning is that the ban allows firm A to *commit not* to price discriminate within the competitive segment. In the second period, one fourth of the consumers in the competitive segment switch supplier since $\alpha'' = 3/8$ and $\beta'' = 5/8$.

The firms' total discounted profits on the *entire market* are obtained by adding up the results in the competitive and sheltered segments, rersulting in

$$\Pi''^A = a(1+\delta)w + (1-a)\,\frac{t(5\delta+12)}{24} \text{ and } \Pi''^B = (1-a)\,\frac{t(7\delta+24)}{48}.$$

Obviously, the dominant firm A generates greater profits than does B. The reasoning is that (i) that it enjoys a monopoly position in its sheltered segment and (ii) that it obtains higher profits in the competitive segment. Firm A serves its sheltered segment and half of the competitive segment such that its total market share becomes $a + 0.5(1-a)$. Firm A's total market share remains identical over the two periods although it does not serve the same consumers in every period.

We address the impact of the ban on "lower-prices-to-rival's-customers" by making a *comparison* with the outcome where the dominant firm A can charge discriminatory prices in the competitive segment. Proposition 2 summarizes the main insights that follow from our analysis.

Proposition 2. *Compare the ban on "lower-prices-to-rival's-customers" to the no-ban case. A ban on "lower-prices-to-rival's-customers" harms the dominant firm's overall profits. This ban*

also lowers rival's overall profits. The dominant firm's market share in the competitive segment remains unaffected.

Figures 3 and 4 illustrate Proposition 2. Both figures graphically outline the main price differences between the no-ban case and a ban on "lower-prices-to-rival's-customers" for the first and the second period, respectively.

The ban on "lower-prices-to-rival's-customers" leads to keener competition as both firms' profits are unambiguously lower when the ban applies. This finding is entirely determined by the competitive segment as the ban leaves firm A's profits in the sheltered segment unaffected. In the second period, firm A's profits decrease from $5t/18$ without ban to $t/4$ while firm B's profits increase to $5t/16$.[17] First-period demand, however, becomes much more elastic as a result of the ban. To see this, we compare the price sensitivity of the marginal consumer in the static model to this two-period model. Given the second-period prices as expressed in (2) and the price $p_1''^B$ charged by firm B in the first period, suppose that firm A changes its first-period price slightly to $p_1''^A - \epsilon$. The marginal consumer is now located at $x'' = 0.5 + \gamma$, where γ measures the marginal consumer's sensitivity to this price change. From Eq. (3), γ satisfies

$$p_1''^A - \varepsilon + t(0.5+\gamma) + \delta\left(\frac{t\,(5(0.5+\gamma)-1)}{6} + t(0.5-\gamma)\right) =$$

$$p_1''^B + (0.5-\gamma)t + \delta\left(\frac{t(3/2-\gamma)}{3} + t(0.5+\gamma)\right)$$

or

$$\gamma = \frac{6\varepsilon}{t(12-5\delta)}.$$

Clearly, when $\varepsilon = 0$ it follows that $\gamma = 0$. Put differently, although the equilibrium first-period prices differ, both firms equally share the competitive segment. However, when $\varepsilon \neq 0$, a forward-looking consumer reacts much more sensitively to a price change as opposed to the static model where $\delta = 0$ and $\gamma = \varepsilon/2t$. This is because the second-period poaching price of the other firm goes up by less than one unit when the dominant firm decreases its first-period price by one unit, as can be seen from (2).[18] This explains why both firms charge more competitive prices

[17] See also Armstrong (2006a), Sections 3.4 and 5.1.

[18] In Fudenberg and Tirole's (2000) model, the opposite holds. Armstrong (2006a) shows that $\gamma = \varepsilon/(2t(1+\delta/3))$ so that the marginal consumer is *less* sensitive to a first-period price change than with the static model: a first-period price cut of one unit by firm A benefits the marginal consumer's current utility but is harmful in the next period as the second-period poaching price of firm B goes *up* by more than one unit.

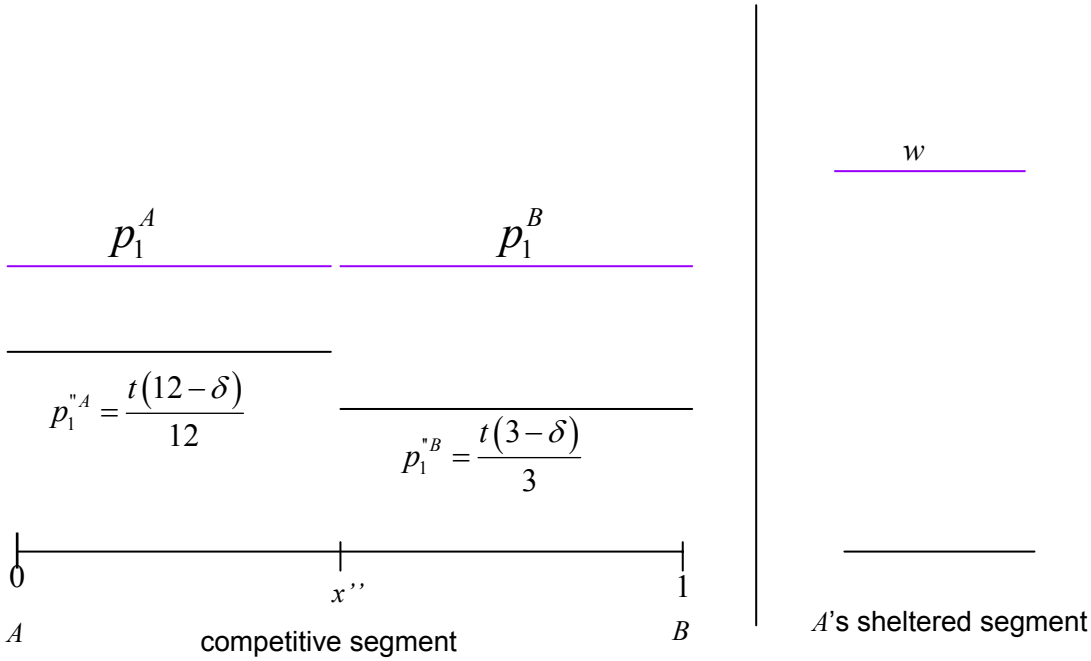

Fig. 3 'Lower-prices-to-rival's-customers' ban: first period

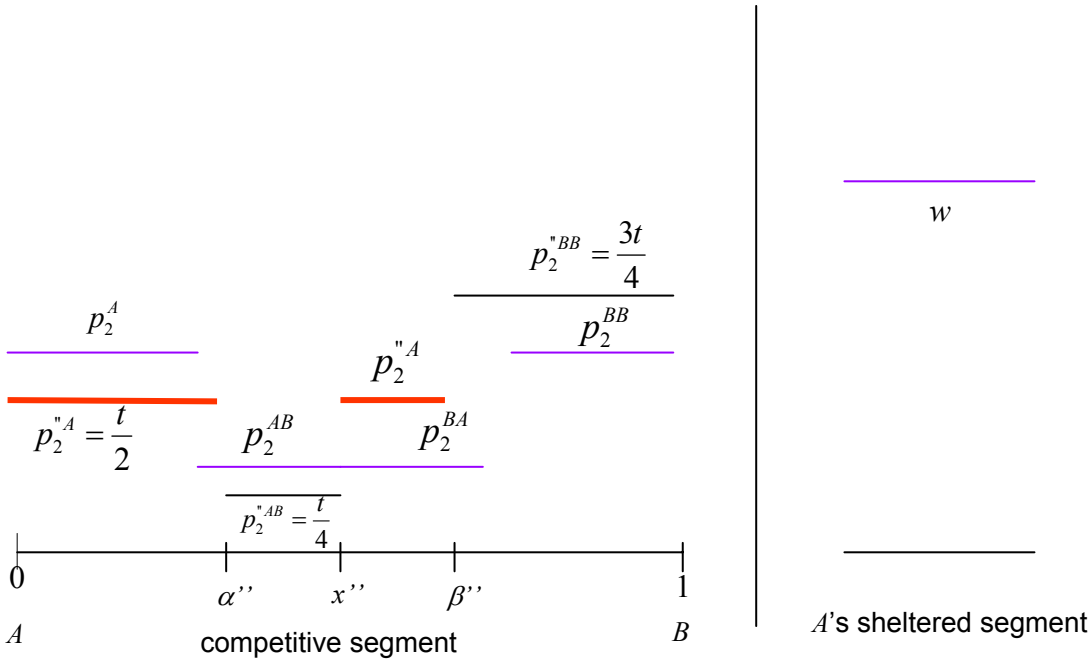

Fig. 4 'Lower-prices-to-rival's-customers' ban: second period

in the first period as compared to the static model.

It is interesting to observe that the ban generates a differential impact on second-period pricing of both firms' first-period customers. The second-period competition for firm A's first-period customers is more pronounced when the ban applies. The reasoning is that firm A's pricing becomes more aggressive as it can charge only one price to keep first-period customers and poach firm B's first-period customers. In contrast, second-period competition for B's first-period customers is relaxed. This explains why it is optimal for firm B to charge first-period prices that are les than firm A's.

Therefore, a ban on "lower-prices-to-rival's-customers" lowers all firms' discounted profits and as such disfavors entry when anticipated.

3 Welfare Analysis, Discussion, and Policy Implications

Welfare Analysis. We now provide a welfare analysis of the bans on "higher-prices-to-sheltered-consumers" and "lower-prices-to-rival's-customers". We compare each of the bans to the no-ban setting. Our findings are presented in Propositions 3 and 4.

Proposition 3. *The ban on "higher-prices-to-sheltered-consumers" increases the consumer surplus in the sheltered segment. In the competitive segment, the ban (i) reduces the consumer surplus and increases the producer surplus, and (ii) decreases the total welfare as fewer consumers are served by their most preferred provider.*

Proof: See Appendix 2.

Proposition 3 shows that a ban on "higher-prices-to-sheltered-consumers" generates redistributive effects. It favours sheltered consumers by introducing competition by means of a price-discrimination ban. This introduction, however, is at the expense of consumers in the competitive segment where competition decreases. Moreover, the discounted average prices are higher across the two periods so that profits increase. Finally, fewer consumers are served by their nearest provider.

Proposition 4. *The ban on "lower-prices-to-rival's-customers" does not affect the social welfare in the sheltered segment. In the competitive segment, however, the ban (i) increases the consumer surplus but reduces the producer surplus, and (ii) increases the total welfare as more consumers are served by their most preferred provider.*

Proof: See Appendix 2.

Proposition 4 shows that the ban on "lower-prices-to-rival's-customers" provides greater total welfare and consumer welfare. This result stems from two complementary forces. First, the ban improves the second-period allocation of consumers as fewer consumers visit their non-nearby provider. Second, overall competition with a ban on "lower-prices-to-rival's-customers" is greater than without a ban.

Discussion. We start our *discussion* by highlighting the intertemporal effects of each ban. We point out how incorporating the expectation of a ban into the firms' strategies may reverse some of the static one-period findings and even lead to unintended results. Then we turn to a comparison of the implications of the different bans. Third, we present the results of a ban that would impose a uniform pricing obligation on the dominant firm; a ban that combines the ban on "lower-prices-to-rival's-customers" and on "higher-prices-to-sheltered-consumers".

First, let us consider the intertemporal effects of the ban on "higher-prices-to-sheltered-consumers". Recall that this ban lowers prices in the sheltered segment and so protects sheltered consumers. However, this protection comes at the cost of relaxing overall competition in the competitive segment. Therefore, the ban facilitates the rivals if the entry costs are fixed. The lower degree of rivalry in the competitive segment, however, also exhibits interesting dynamic and redistributional effects (see Figures 1 and 2) compared to the no-ban benchmark. Firm A's first-period consumers benefit from lower first-period prices while firm B's consumers pay higher first-period prices. The opposite happens in the second period as firm B's first-period customers enjoy lower prices while firm A's first-period customers are harmed.

Our analysis has thus far assumed that firms and consumers rationally anticipate the ban on "higer-prices-to-sheltered-consumers". Consider now how our second-period findings would be modified when firms would not be able to behave strategically from period one to the next. A first implication is that, without anticipation, there are no intertemporal linkages or dynamic effects between the two periods. To see this, suppose that the market would have been equally divided in the first period or $x' = 0.5$. This assumption allows us to identify the marginal effects that anticipation generates on second-period outcomes, as deviations from $x' = 0.5$ in our setting stem from first-period strategic behavior. To understand the marginal effects, it should be clear that any deviation of x' from 0.5 produces opposing effects in A's (the "left") and B's (the "right") segments. In particular, when $x' > 0.5$, competition increases in the "right" segment but relaxes in the "left" segment. The reasoning is that a rival's poaching strategy increases

in its own first-period market share in the competitive segment. Anticipation of the ban on "higher-prices-to-sheltered-consumers", however, gives the dominant firm incentives to build-up first-period market share to protect its sheltered segment from future competition. As a result, it charges low prices in the first period, which leads to more relax second-period competition in A's hinterland. However, sharper second-period competition in B's hinterland takes place. Consequently, firm A's first-period market share endogenously increases as a result of the ban on "higher-prices-to-sheltered-consumers". Therefore, although the ban decreases A's profits, the interemporal effects lead to higher first-period market shares for the dominant firm, which partly undermines the ban's goal.

Second, consider the ban on "lower-prices-to-rival's-customers". Typically, the motivation by regulators to introduce this ban has been to encourage entry and by competition authorities to enable entry and/or to prevent exit of at least as efficient competitors. Our analysis shows that this ban leaves the sheltered segment unaffected, but leads to more intense competition in the competitive segment. Therefore, a ban on "lower-prices-to-rival's-customers" would result in more difficult entry when entry costs are no longer covered by the decrease in profits. This suggests that the ban would miss its intended purpose.[19] How can these findings be reconciled? First, when we consider second-period competition only, the ban intensifies competition in A's hinterland but relaxes competition in B's hinterland. The reasoning is that A's price now is set both to serve its hinterland (its strong market segment) and to poach its rival's customers (its weak market segment). This ban decreases A's price in its strong market segment, and increases A's price in its weak market segment. These second-period results are identical to those derived from a static analysis where only second-period competition would be considered since $x'' = 0.5$. Thus, a ban on "lower-prices-ro-rival's customers" does indeed facilitate entry as compared to no ban when applying only a static (second-period) analysis. This second-period result is in line with Thisse and Vives (1988) who analyze oligopolistic price discrimination with asymmetric best-responses in a static framework.[20] They also find that competition decreases when one firm

[19] Relatedly, our model assumes that with a ban on "higher-prices-to-sheltered-consumers", the dominant firm maximizes its profits by choosing to be present in the competitive segment. Chen (2007) also considers the opposite case where the dominant firm finds it optimal to serve the sheltered segment only with a price discrimination ban. This leaves its rival with a monopoly on the competitive segment. A ban on "higher-prices-to-sheltered-consumers" then results in a monopoly on both segments. Clearly, such a ban harms consumer welfare and may miss its intented purpose.

[20] Corts (1998) introduces the notion of asymmetric best-responses, where one firm's weak market is the other firm's strong market and vice versa. In such a setting, price discrimination may result in lower profits for all firms as compared to the equilibrium profits under uniform pricing. See also Bester and Petrakis (1996) for a

is forbidden to price discriminate. Second, when we take into account the first-period effects, however, the results revese. Recall that anticipation of the ban does not modify second-period competition when competition takes place in the first period. However, first-period competition itself incorporates the presence of a ban in the second period. Indeed, first-period demand with a ban on "lower-prices-ro-rival's-customers" is much more elastic than without a ban. This increased price sensitivity leads to keener first-period competition. Summing up, we can state that firm B's total profits are lower because this first-period pro-competitive effect outweighs the increased second-period profits realized in B's hinterland.

Third, consider a uniform pricing obligation on the dominant firm. This general ban on price discrimination is a combination of both bans discussed in the main text and is worked out in Appendix 1. In the second period, the dominant firm is obliged to charge a uniform price within the competitive segment and across both segments. As with the ban on "higher-prices-to-sheltered-consumers", the competition or regulatory authority needs the first period to observe the dominant firm's behaviour and to establish dominance before it can intervene in the second period. The dominant firm, its rival and the consumers in the competitive segment all anticipate this uniform pricing obligation and behave accordingly in the first period. The results hinge on the size of the sheltered segment. Consider first a small-sized sheltered segment (low a). Intuitively, this ban then comes close to the ban on "lower-prices-to-rival's-customers" as the sheltered segment is relatively unimportant. The ban then leads to lower second-period prices in A's hinterland and sheltered segment. Therefore, sheltered consumers strongly benefit from such a ban. In contrast, second-period prices increase in B's hinterland. Without dynamic effects (i.e. when $\widetilde{x} = 0.5$), the latter increase would even become larger. Therefore, with a static analysis the ban achieves its two goals – protecting sheltered consumers and enhancing entry. The first-period competition, however, is much sharper than without a ban. This keener first-period competition dominates, generating overall lower profits for firm B. Therefore, for low a, our dynamic model shows that the ban does not ease entry. Second, consider a larger-sized sheltered segment (high a). Intuitively, in this case, the main forces are similar to those of a ban on "higher-prices-to-sheltered-consumers". Firm B's profits are higher compared to the no-ban case. Therefore, this ban does, indeed, facilitate and protect entry. The goal of protecting sheltered consumers is still met but to a lesser extent. With a large sheltered segment, all second-period prices increase compared to the no-ban scenario. This implies that firm B's second-period profits increase due to the ban. This increase can be decomposed into two components. First,

one-period duopoly model where price discrimination decreases every firm's profits.

firm B's profits are also higher when applying a static analysis only (i.e. $\widetilde{x} = 0.5$). Second, the dynamic effects through a $\widetilde{x} > 0.5$ stimulate firm B's profits even further. Also, all first-period prices are higher than without a ban.

Policy implications. As far as the *policy implications* are concerned, the key question is whether or not competition policy should ban "higher-prices-to-sheltered-consumers" and/or ban "lower-prices-to- rival's customers". The answer to this question depends, amongst other things, on the policy objectives. Does competition policy take consumer surplus or total surplus as its assessment standard? Does competition policy have an explicit redistributive purpose. For example, should sheltered consumers be protected at the cost of consumers at the competitive segment?[21]

If the objective of competition policy is (1) to optimize consumer surplus; and (2) not to redistribute surplus between groups of consumers, then the ban on "lower-prices-to-rival's-customers" serves to meet this objective. Whether or not a ban on "higher-prices-to-sheltered-consumers" should be imposed is ambiguous and depends on the relative consumer surplus changes due to the ban in the sheltered and competitive segments.

Another point that is relevant for competition policy is that a static analysis is not appropriate for assessing competitive practices that essentially exhibit intertemporal features. In our model, from a static point of view, a ban on price discrimination encourages entry. From a dynamic perspective, however, our paper shows that this is not necessarily the case. The ban on "higher-prices-to-sheltered-consumers" does, indeed, encourage entry. The ban on "lower-prices-to-rival's-customers", on the contrary, may have an exclusionary effect as it discourages entry by reducing entrants' profits.

A final related point is that prohibiting certain business practices by dominant firms can have various effects that ideally should all be taken into account. For example, the ban on "lower-prices-to-rival's-customers" is exclusionary in the sense that it discourages entry. However, it reduces at the same time "exploitative" damage due to above-marginal-cost pricing, because it intensifies competition. Policy discussions on the legality or illegality of certain practices should take all these effects into account and be presented as trade-offs.

There is much debate on both sides of the Atlantic whether or not selective price cuts above marginal cost can enhance consumer surplus. Following the *Brooke* and *American Airlines* cases in the US, it looks as though the current US position is that selective price cuts above marginal

[21] See Farrell and Katz (2006) for a discussion of these and related issues.

cost in response to competitive threats should be allowed. Consequently, the ban on "lower-prices-to-rival's-customers" is not enforced under US antitrust policy even though it would lead to higher consumer surplus. Under EC competition policy, this form of selective price cuts may be prohibited (see e.g. *Compagnie Maritime Belge*).

4 Conclusions

In his call for a stronger economic basis for the response to the abuse of market power, Vickers (2005) observes that "the natural and mostly desirable response to competition by dominant firms will often involve (above-cost) price discrimination. This suggests that hostility to this *form* of response to competition would be wrong, but that in limited economic circumstances the evidence as a whole might justify a finding of abuse... Which circumstances is a matter in need of more economic analysis".[22] Our paper aims to contribute to the response to this call by studying the effects on competition of prohibiting above marginal cost price discrimination by a dominant firm.

In particular, we study the competitive and welfare effects of two bans on price discrimination, when firms and consumers strategically anticipate that such bans will be imposed on the dominant firm. We analyze these bans using a two-period model where the market exhibits a competitive and a sheltered segment. The first ban prohibits the dominant firm from charging higher prices to its sheltered consumers. This ban decreases competition in the competitive segment and increases the initial market share of the dominant firm. Furthermore, this ban has a redistributive effect on welfare: while consumer surplus in the sheltered segment increases, the sum of the consumer and the producer surplus decreases in the competitive segment.

The second pricing restriction is a ban on "lower-prices-to-rival's-customers", which would be motivated by prohibitions of win-back campaigns. While competition policy authorities have designed this ban to protect competitors and stimulate entry, we show that this ban leads to more intense competition. This result shows that a dynamic approach is the key for taking all effects into account, as a static one-period analysis shows that competition relaxes in the competitive segment.

[22] See Vickers (2005), page F257.

5 Appendix

Appendix 1: Uniform pricing obligation A general ban on price discrimination implies that firm A can neither price discriminate neither *across* its sheltered segment and the competitive segment nor *within* the competitive segment. Therefore firm A faces a uniform pricing obligation in the second period. It is clear that such an obligation introduces a link between the sheltered segment and the competitive segment.

Firm A optimally serves its sheltered segment at price w in the first period. The ban implies however that firm A sets a price $\widetilde{p}_2^A < w$ for all its second-period customers, including the sheltered segment. The "$\widetilde{\ }$" on top of the symbol denotes this general ban or the uniform pricing obligation.

Consider the competitive segment. Suppose first-period competition leads to firm A serving consumers to the left of $\widetilde{x}$, wherefrom B served consumers to the right of $\widetilde{x}$. In the second period, there are two indifferent consumers. The first is located at $0 \leq \widetilde{\alpha} \leq \widetilde{x}$ and is characterized by

$$\widetilde{p}_2^A + t\widetilde{\alpha} = \widetilde{p}_2^{AB} + t(1 - \widetilde{\alpha})$$

while the second indifferent consumer located at $\widetilde{\beta}$ is characterized by

$$\widetilde{p}_2^A + t\widetilde{\beta} = \widetilde{p}_2^{BB} + t(1 - \widetilde{\beta}).$$

Firm A maximizes its second-period profits in both segments

$$\widetilde{\Pi}_2^A(\widetilde{p}_2^A) = \widetilde{p}_2^A \left[a + (1-a)\left(\widetilde{\alpha} + \widetilde{\beta} - \widetilde{x}\right)\right]$$

and firm B maximizes

$$\widetilde{\Pi}_2^B(\widetilde{p}_2^{BB}, \widetilde{p}_2^{AB}) = (1-a)\left[\widetilde{p}_2^{BB}(1 - \widetilde{\beta}) + \widetilde{p}_2^{AB}(\widetilde{x} - \widetilde{\alpha})\right].$$

The first-order conditions result in

$$\begin{aligned}
\widetilde{p}_2^A &= \frac{t(2 - \widetilde{x}\,(1-a))}{3\,(1-a)} \\
\widetilde{p}_2^{AB} &= \frac{t\,(5\widetilde{x}\,(1-a) + 3a - 1)}{6} \\
\widetilde{p}_2^{BB} &= \frac{t(5 - \widetilde{x}\,(1-a) - 3a)}{6\,(1-a)}.
\end{aligned}$$

Second-period prices depend on a as this general ban implies uniform pricing between the sheltered and the competitive segment for firm A. When $a = 0$, observe that the model coincides with the ban on "lower-prices-to-rival's-customers".

We now turn to first-period competition. The forward-looking first-period indifferent consumer in the competitive segment is located at $\widetilde{x}$ such that

$$\widetilde{p}_1^A + t\widetilde{x} + \delta[\widetilde{p}_2^{AB} + t(1-\widetilde{x})] = \widetilde{p}_1^B + t(1-\widetilde{x}) + \delta[\widetilde{p}_2^A + t\widetilde{x}].$$

Note that the indifferent consumer opting for firm B expects to be poached by firm A at a price $\widetilde{p}_2^A$ "only". This price is not very aggressive as it is identical to the price charged by A to its first-period customers in both the competitive and the sheltered segments. In visiting firm A in the first-period, the indifferent consumer anticipates a more attractive second-period poaching price by firm B. After substitution of both firms' second-period prices, one obtains firm A's first-period market share on the competitive segment:

$$\widetilde{x} = \frac{6(\widetilde{p}_1^B - \widetilde{p}_1^A) + t\,(6-\delta) - a\left(2(\widetilde{p}_1^A - \widetilde{p}_1^B) + 3t\,(\delta-2)\right)}{t(12-5\delta)\,(1-a)}.$$

Firm A maximizes the following total discounted profit in both segments

$$\widetilde{\Pi}^A(\widetilde{p}_1^A, \widetilde{p}_1^B) = aw + (1-a)\,\widetilde{p}_1^A\widetilde{x} + \delta\widetilde{p}_2^A\left[a + (1-a)\left(\widetilde{\alpha} + \left(\widetilde{\beta} - \widetilde{x}\right)\right)\right]$$

whereas firm B maximizes

$$\widetilde{\Pi}^B(\widetilde{p}_1^B, \widetilde{p}_1^A) = (1-a)\left[\widetilde{p}_1^B(1-\widetilde{x}) + \delta\left[\widetilde{p}_2^{BB}(1-\widetilde{\beta}) + \widetilde{p}_2^{AB}(\widetilde{x}-\widetilde{\alpha})\right]\right].$$

From the first-order conditions, an interior solution results in

$$\begin{aligned}
\widetilde{p}_1^A &= \frac{t\,(12-\delta)}{12} + \frac{at\delta\,(156-89\delta)}{6\,(1-a)\,(54-31\delta)} \\
\widetilde{p}_1^B &= \frac{t\,(3-\delta)}{3} + \frac{2at\delta\,(15-8\delta)}{3\,(1-a)\,(54-31\delta)}.
\end{aligned}$$

Competition with a uniform pricing obligation leads to different first-period prices charged by both firms. Dominant firm A's prices outweigh its rival's as $\widetilde{p}_1^A > \widetilde{p}_1^B$. The reasoning stems from the anticipated second-period poaching behavior by both firms. Similar to their reaction to the ban on "lower-prices-to-rival's-customers", consumers anticipate that the poaching price of the dominant firm A will be less aggressive than that of rival firm B. However, this force is now even stronger as the poaching aggressiveness of dominant firm A decreases in a.

Firm A's first-period market share in the competitive segment is

$$\widetilde{x} = \frac{1}{2\,(1-a)} - \frac{3a(18-11\delta)}{2(1-a)(54-31\delta)},$$

which is greater than 0.5. Consequently, firm A's second-period market share in the competitive segment entails

$$\widetilde{\alpha}+\widetilde{\beta}-\widetilde{x}=\frac{1}{2\left(1-a\right)}-\frac{3a(30-17\delta)}{2(1-a)(54-31\delta)},$$

and is less than 0.5. Firm A's total market share in both segments, therefore, decreases from period one to period two, showing that the ban increases the initial dominance but reduces firm A's dominance over time.

The second-period equilibrium prices become

$$\begin{aligned}\widetilde{p}_2^A &= \frac{t}{2\left(1-a\right)}\left[1+\frac{a\left(18-11\delta\right)}{54-31\delta}\right]\\ \widetilde{p}_2^{AB} &= \frac{t}{4\left(1-a\right)}\left[1+\frac{a\left(18-7\delta\right)}{54-31\delta}\right]\\ \widetilde{p}_2^{BB} &= \frac{3t}{4\left(1-a\right)}\left[1-\frac{a\left(30-17\delta\right)}{54-31\delta}\right].\end{aligned}$$

Discounted profits for both firms on both segments amount to

$$\begin{aligned}\widetilde{\Pi}^A &= aw+\left(1-a\right)\frac{t(5\delta+12)}{24}-\frac{at\delta\left[2a\left(1372\delta^2-4809\delta+4212\right)-3\left(1767\delta^2-6178\delta+5400\right)\right]}{6\left(1-a\right)\left(54-31\delta\right)^2}\\ \widetilde{\Pi}^B &= \left(1-a\right)\frac{t(7\delta+24)}{48}-\frac{at\delta\left[6a\left(569\delta^2-1983\delta+1728\right)-4681\delta^2+6\left(2723\delta-2376\right)\right]}{12\left(1-a\right)\left(54-31\delta\right)^2}.\end{aligned}$$

We will now *compare* the uniform pricing obligation of the dominant firm with our no-ban scenario. Recall that, when $a=0$, the ban effectively becomes identical to a ban to "lower-prices-to-rival's-customers". In that case, prices are lower in the first period and in firm B's first-period segment. Second-period prices in firm A's first-period segment are higher compared to the no-ban scenario. Overall competition is keener compared to the base case, which implies that such a ban discourages entry. All prices in the competitive segment increase in a, which indicates that the results on the intensity of competition and the price levels hinge on the size of the sheltered segment a. For a low enough a, overall competition will still be keener than in the no-ban case, making the ban entry deterring. For a high enough a, however, competition will be less severe so the rival firm's profits are higher than in the no-ban case. That is, firm B enjoys higher overall profits than under the no-ban case when the ban sufficiently lowers the aggressiveness of the dominant firm A. The ban also produces interesting intertemporal effects. Anticipation of this uniform pricing obligation for the dominant firm leads to larger first-period market shares: the dominant firm serves more than half of the competitive segment in addition to its sheltered segment. Second-period dominance becomes less important as $\widetilde{x}<0.5$.

Appendix 2 Proof of Proposition 3: The ban on "higher-prices-to-sheltered-consumers" reduces the prices in the sheltered segment, which imples that consumer welfare in the sheltered segment increases. We first consider the competitive segment.

(i) Consumer Surplus. We first display the consumers' financial and non-financial expenditures in the competitive segment without ban. The sum of financial and non-financial outlays equals

$$\frac{t(1-a)\left(43\delta+45\right)}{36}. \tag{4}$$

Consumers' financial outlays are identical to firms' profits on the competitive segment and equal

$$(1-a)\,\frac{t(8\delta+9)}{9}. \tag{5}$$

Non-financial outlays are the discounted total transportation costs, which equal

$$(1-a)\,\frac{t(11\delta+9)}{36}=\frac{(1-a)t}{4}+(1-a)\,\delta t\left[\frac{2}{3}\frac{1}{6}+\frac{1}{3}\frac{7}{12}\right]. \tag{6}$$

The first term at the RHS of the above expression represents the first-period transportation costs. The second term displays the discounted second-period transportation costs, where 2/3 of the consumer population need to travel a distance of 1/6 on average whereas the remaining 1/3 of the population needs to travel a distance of 7/12 on average.

With a ban on higher-prices-to-sheltered-consumers, total outlays become

$$\frac{t}{36\left(1-a\right)}\left[\frac{3a^2\left(853\delta^3-1887\delta^2-4293\delta+10935\right)}{\left(27-11\delta\right)^2}-6a\left(11\delta+15\right)+\left(43\delta+45\right)\right]. \tag{7}$$

These outlays can be decomposed into financial outlays (the sum of firms' profits in the competitive segment) represented by

$$\frac{t}{9\left(1-a\right)}\left[\frac{3a^2\left(124\delta^3-3\delta^2-1296\delta+2187\right)}{\left(27-11\delta\right)^2}-6a\left(2\delta+3\right)+\left(8\delta+9\right)\right] \tag{8}$$

and non-financial outlays, which can be written as

$$\begin{aligned}&(1-a)t\left[x'\left(\frac{x'}{2}\right)+\left(1-x'\right)\left(\frac{1-x'}{2}\right)\right]+\\&\quad(1-a)\,\delta t\left[\alpha'\frac{\alpha'}{2}+\left(x'-\alpha'\right)\left(\frac{2-x'-\alpha'}{2}\right)+\left(\beta'-x'\right)\left(\frac{\beta'+x'}{2}\right)+\left(1-\beta'\right)\left(\frac{1-\beta'}{2}\right)\right]\\&\qquad=\frac{t}{36\left(1-a\right)}\left[\frac{9a^2\left(119\delta^3-625\delta^2+297\delta+729\right)}{\left(27-11\delta\right)^2}-18a\left(1+\delta\right)+\left(11\delta+9\right)\right].\end{aligned} \tag{9}$$

The first term of the LHS of the above expression represents the first-period transportation costs. The second term of the LHS are the discounted second-period transportation costs with account taken of consumers' purchase decisions.

A comparison of total consumer expenditures with and without the ban on "higher-prices-to-sheltered-consumers" shows that the total consumer expenditures are higher when the ban applies. Comparison of Eq. (5) with Eq. (7) shows that the producer surplus is higher with a ban on "higher-prices-to-sheltered-consumers".

(ii) Consumer and Producer Surplus. The unweighted sum of producer and consumer surplus is identical to the transportation costs incurred by customers. Comparison of Eq. (6) with Eq. (9) shows that transportation costs are higher with a ban than without a ban. This completes the proof.

Proof of Proposition 4:

The ban on "lower-prices-to-rival's-customers" does not change firm A's pricing in the sheltered segment. Consequently, social welfare in the sheltered segment remains identical to the welfare in the absence of this ban. The ban, however, changes pricing behaviour and consumers' decisions in the competitive segment.

(i) Consumer Surplus. The consumers' financial and non-financial expenditures on the competitive segment without a ban are given by Eq. (4). With a ban on "lower-prices-to-rival's-customers", total outlays become

$$\frac{t(1-a)\left(61\delta+120\right)}{96}. \tag{10}$$

These outlays can be decomposed into financial outlays (the sum of firms' profits in the competitive segment)

$$\frac{t(1-a)\left(17\delta+48\right)}{48},$$

and non-financial outlays

$$\frac{(1-a)t}{4}+(1-a)\,\delta t\left[\frac{3}{4}\frac{3}{16}+\frac{1}{4}\frac{9}{16}\right]=\frac{t(1-a)\left(9\delta+8\right)}{32}. \tag{11}$$

The first term of the LHS of the above expression reflects the first-period transportation costs. The second term represents the discounted second-period transportation costs: 3/4 of the consumer population need to travel the distance 3/16 on average, whereas 1/4 needs to travel a distance 9/16 on average.

A simple comparison of Eqs. (4) and (10) shows that the consumer outlays are higher without a ban. The discounted average prices are lower. In particular, average prices in the first-period are lower. The average second-period prices for A's first-period customer base are lower, whereas they are higher for B's first-period customer base. In addition, more consumers are served by their most preferred provider. The ban on "lower-prices-to-rival's-customers", therefore, is consumer friendly and generates a higher consumer surplus.

Consider now the producer surplus. The above expressions show that profits are higher without a ban. Thus a ban intensifies competition on the competitive segment.

(ii) Consumer and Producer Surplus. The effect on total welfare from introducing this ban amounts to a comparison of the transportation costs incurred by the consumers. Equations (6) and (11) show that transportation costs are lower with a ban on "lower-prices-to-rival's-customers" than without a ban. This completes the proof.

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